

# Patient safety matters: reducing the risks of nasogastric tubes

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**ABSTRACT** – Nasogastric tube insertion is a common clinical procedure carried out by doctors and nurses in NHS hospitals daily. For the last 30 years, there have been reports in the medical literature of deaths and other harm resulting from misplaced nasogastric tubes, most commonly associated with feed entering the pulmonary system. In 2005 the National Patient Safety Agency in England assembled reports of 11 deaths and one incident of serious harm from wrong insertion of nasogastric tubes over a two-year period. The agency issued a safety alert setting out evidence-based practice for checking tube placement. In the two and a half years following this alert the problem persisted with a further five deaths and six instances of serious harm due to nasogastric tube misplacement. This is a potentially preventable error but safety alerts advocating best practice do not appear to reliably reduce risk. Alternative solutions, such as standardising procedures, may be more effective.

**KEY WORDS:** nasogastric tube, patient safety, safety alert

## Introduction

Physicians have been intubating the gastrointestinal tract to allow artificial feeding since ancient times.<sup>1</sup> Today over 275,000 nasogastric tubes are supplied to the NHS annually (personal communication, NHS Supply Chain, May 2009). As with most medical procedures, there are risks to the use of these tubes. Some complications (eg epistaxis) are common and minor, others (eg oesophageal perforation and pneumothorax) are rare but serious.

In recent years patient safety has emerged as a major issue of concern to healthcare providers.<sup>2</sup> Various approaches to improving safety have been used, including attempts to apply the experience of safety experts from other industries to hospital care. Over time, understanding of what approaches have most impact on reducing medical errors has grown. In this paper, the nature and scale of the problem of nasogastric tubes in England is reviewed. The limited impact of a safety alert is highlighted and the issue of nasogastric tube safety is used to illustrate other approaches to improving patient safety.

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## Problems of nasogastric tubes in the NHS

In April 2004, an inquest was held into the unexpected death of an eight-year-old girl in an NHS hospital in England. She had required intubation and ventilation due to respiratory failure and was temporarily unable to eat or drink. A nasogastric tube was passed to administer enteral feed. The position of the tube was checked with the whoosh test (auscultating the epigastrium for bubbling as air is injected down the tube) and litmus testing of the aspirate. The whoosh test was positive while the aspirate from the tube turned blue litmus paper pink, suggesting gastric acidity. The tip had in fact punctured the pleura to lie in the pleural cavity. When enteral feed was administered through the tube her respiratory function worsened. The whoosh and litmus paper test were repeated. Again, they appeared to confirm the positioning of the tube in the stomach. Feeding continued and the girl died. At post mortem a large quantity of feed was found in her pleural cavity. Following the inquest, the coroner, under his statutory powers, issued a notice to the NHS. He sought to avoid a recurrence and drew attention to hazards in routine clinical practice.<sup>3</sup>

The National Patient Safety Agency (NPSA) receives all the adverse event reports from the NHS. In the same two-year period as the case described above, 10 other deaths related to misplaced nasogastric tubes were reported to the NPSA. This prompted a thorough investigation, culminating in February 2005 in a patient safety alert to the NHS. It instructed providers to confirm the tube's correct placement with the use of pH indicator strips or X-rays prior to commencing feeding through the tube. It prohibited the use of the whoosh test, blue litmus paper and the absence of respiratory distress as indicators of correct positioning. All actions were to be implemented by September 2005.<sup>4</sup>

In the two and a half year period after compliance with the alert was required, 210 further incidents relating to nasogastric tube placement were reported. These included 26 where enteral feed was introduced into the lungs. Ten of these apparently had appropriate checks carried out, either X-rays or pH paper testing of aspirates. Fifteen had unclear or inappropriate checks. One had not been checked at all. Five of these 26 patients died and a further six experienced severe harm. In none of these cases was there any suggestion of abnormal oesophageal anatomy or other predisposing factor for tube misplacement. In the remaining 184 reports there were many instances of outlawed checks or no checks at all being carried out.<sup>5</sup> The overall incidence of serious events related to nasogastric tube placement in the NHS changed little following the alert.

## The wider context

Authoritative nursing texts from the early 20th century reassured the reader that passage of a nasogastric tube into the trachea was unlikely and, if it did happen, a sudden 'stop' would alert the clinician.<sup>6</sup> This was overly reassuring. Nasogastric tube misplacement is common and can go unrecognised. A variety of checks have been developed over the years to confirm the position of the tip of the tube. These include the whoosh test, X-rays (to confirm passage of a radio-opaque tube beyond the diaphragm), testing the tube aspirate for pH, bilirubin, pepsin or trypsin, observing for bubbling from the tube or respiratory distress on passing the tube, and checking for CO<sub>2</sub> at the end of the tube.<sup>7</sup>

In 1978 the passage of a nasogastric tube into the pleural space was first reported.<sup>8</sup> Three years later a fatal case of intrapleural feeding via a misplaced nasogastric tube was reported.<sup>9</sup> Since then reports of intrapleural or tracheobronchial feeding have appeared frequently. It continues to be reported today.<sup>10</sup> It occurs in a variety of clinical situations, including intubated patients. In these reports, tube misplacement took place in anatomically normal patients without an underlying oesophageal abnormality or pathology.

It is impossible to quantify the risk of nasogastric tubes precisely. It is difficult to establish a denominator since the number of tubes inserted for feeding is not recorded. Moreover, many adverse events are likely to be unreported. One case series reported 2% of feeding tubes passed in an intensive care unit were inserted into the pulmonary system, with 0.7% leading to a major complication and 0.3% to death.<sup>11</sup> Another reported a 0.3% complication rate in feeding tubes inserted in obtunded patients.<sup>12</sup> Clearly these are highly specific patient groups but even if these error rates are only representative of critical care units then the problem is substantial.

Nasogastric tubes can cause harm through trauma on insertion, for example oesophageal perforation or pneumothorax. However, fatalities are usually due to feed being inserted through a misplaced tube. This has led to a focus on checking the nasogastric tube position rather than preventing misplacement. The report of a 1981 fatality noted a false positive whoosh test, but it did not recommend the use of this test be stopped.<sup>9</sup> Later reports confirm the unreliability of the test and advise it not be used.<sup>13</sup> Of the other methods available, pH testing and X-rays are often considered the gold standards.<sup>14</sup> Even these two methods are fallible. Many patients in medical and intensive care units are on proton-pump inhibitors (PPIs) that may make checking for gastric acidity unreliable (although a prospective study piloting the NPSA guidelines for nasogastric tube placement found this to be a problem in only a relatively small number of patients). Feed itself can give an acidic result, falsely suggesting the tube tip lies in the stomach. X-rays can be misleadingly reassuring.

The absence of a wholly reliable test means that, in common with most medical interventions, nasogastric feeding will never be completely without risk. More than 25 years have passed since the potentially fatal complication of intrapleural feeding was first described in the medical literature. In this time, the

evidence for and against methods of checking tube position has grown. A national alert has been issued according to this evidence. It is clear that the use of appropriate checking methods can reduce this risk substantially. Yet clinicians still regularly fail to minimise the risks of nasogastric tube placement by complying with best practice.

## Possible solutions

The evidence base for patient safety interventions is sparse compared to other areas of medical practice. What evidence is available suggests that the issuing of alerts or warnings is a relatively weak intervention. Guidelines are followed inconsistently in a wide range of clinical circumstances.<sup>15,16</sup> In the NHS the impact of other NPSA safety alerts has been inconsistent.<sup>17,18</sup> The reasons for alerts and guidelines not being adopted are complex. They involve professional norms and individual attitudes and behaviours as well as wider systems factors.<sup>19</sup> Other approaches to improving patient safety are needed.

Checklists have been shown to reduce risks and improve outcomes in a variety of clinical circumstances and interventions, albeit more complex than nasogastric tube insertion.<sup>20,21</sup> Their application here could help ensure correct checks are carried out each time a tube is inserted. A checklist on tube placement could be included within the packaging of nasogastric tubes. This would also serve to heighten awareness of the risks of the procedure at the time of insertion.

Simplifying a process can improve safety and compliance with good practice. The use of blue litmus paper has been exposed as potentially misleading in the checking of nasogastric tube placement. Instead, pH paper is much more reliable. It gives a specific pH value rather than an indication simply of acidity. Litmus paper is now no longer supplied to the NHS, which is a step toward preventing poor practice. Some will remain in the system though and may be available on wards. A busy clinician could understandably take the short cut of using what was most easily to hand. Equally, there may be no test paper readily available, tempting a clinician to use the whoosh test. Including pH paper in the packaging of every nasogastric tube could be achieved simply and cheaply. This would make the use of the most appropriate test effortless and possibly improve compliance.

The strong and visible involvement of leaders in patient safety initiatives is important. This particular safety alert may have been weakened by the failure to distribute it to the right people as it was sent to directors of nursing for action.<sup>4</sup> Nurses insert the majority of nasogastric tubes but doctors will place some, particularly if the insertion has been difficult.<sup>11</sup> Many of the incidents involving nasogastric tubes reported to the NPSA following the safety alert concerned tubes inserted by medical staff. It is unclear if the doctors described had disregarded the NPSA safety alert or were simply unaware of its existence. Either way, strong instruction from senior colleagues would make compliance with the alert's directions much more likely.

An NPSA safety alert could, in some ways, be considered analogous to an airworthiness directive (AD) in the airline industry.

Airlines, and individuals operating aircraft, are obliged to report any event that could represent a safety issue to their national safety regulator (the Civil Aviation Authority in the UK). These reports are then passed to the manufacturer who is responsible for developing a solution to the problem. This solution is then passed back to the national authority that designates it as an AD that is then distributed to all airlines. An airline's licence to operate is dependant on their compliance with ADs.

NPSA safety alerts are generated on the basis of the incident reports received through their National Reporting and Learning System. Incident reports are voluntarily submitted by NHS staff following any event they feel may have a bearing on patient safety. There is no statutory obligation to report. If a significant number of similar incidents are reported the NPSA may investigate and then issue a safety alert to the NHS. This alert will be sent to all relevant trusts designated 'for action' by a specified person, usually the medical or nursing director. There will also be a list of staff that it is recommended are informed of the alert. The alert will contain a deadline by which the alert should be complied with. How an organisation responds to an alert and how it effects the necessary change is not proscribed. Trusts are, however, expected to respond to alerts within the given time frame, stating they are compliant with the alert's instructions. The alerts themselves do not carry any statutory weight and there are no direct sanctions for trusts or individuals not complying with an alert's recommendations.

A key difference between safety alerts in healthcare and ADs in the airline industry is the possibility of severe penalties for organisations and individuals not complying with an AD. The differences, however, are not just in the legal status of each type of alert. Lack of awareness of alerts is particularly symptomatic of the absence of a safety-orientated culture within healthcare. Airworthiness directives are a routine part of life in the airline industry alongside incident reports. Conversely, in healthcare, routine incident reports are not widely disseminated and the issuing of a safety alert is an extraordinary event. Clinicians are commonly completely unaware of the issuing of alerts, even when directly relevant to their area of practice. If clinicians more routinely encountered incident reports then there would be a raised awareness of safety issues generally, perhaps meaning alerts would be anticipated and acted on more reliably.

## Conclusions

Improving patient safety remains a persistent challenge for healthcare organisations. Current mechanisms are only partially effective. Simple practical changes could be made in the short term, for example to the packaging of nasogastric tubes. Lessons should be learned about how to target safety alerts in the medium term. This will improve the response to other safety hazards as they are identified. The long-term aim must be for fundamental action that will lead to significant culture change within healthcare, where safety takes on a higher priority and is pursued proactively. This will require strong and determined leadership. It will need safety awareness to become part of the normalisation of all staff within the health service. This must

start at undergraduate level and continue into staff induction and beyond. If this is made a reality then unnecessary deaths from unsafe medical practice can be prevented.

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